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Effects of the energy price crisis on European households

Socio-political challenges and policy options

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Imprint

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Executive Summary

Fossil fuel prices in Europe have increased notably since the onset of Russia's invasion of Ukraine. Prices will likely remain high, and may increase even further, depending on demand or supply reductions by Europe and Russia, respectively. This paper assesses the implications of higher energy prices for households under different price scenarios for natural gas, oil, and coal in the short-term.[1] Our analysis is based on detailed microsimulations on representative household expenditure data for 24 of 27 countries of the European Union,[2] which are combined with multi-regional input-output data to account for direct and indirect cost effects.

Our analyses reveal important insights and hold some implications for policy-making:

Higher prices affect households across EU countries differently

- Financial impacts on households following price increases for natural gas, oil and coal in our 'baseline scenario' – that corresponds to current wholesale price levels – can be high across EU countries. They would constitute average additional 'overnight' costs for households of more than 20% of their total expenditures in Hungary, Romania, Italy, Czech Republic and Germany. Households in Denmark, Sweden and France would, on average, be least affected (about 10% of their total expenditures).
- Higher natural gas prices and consequently increasing domestic heating costs are the most relevant cost drivers in countries, which face the highest additional costs. Across countries, households using gas for heating are substantially stronger affected than others.
- Generally, cost increases for direct energy use are the most important driver of additional costs across all countries. Cost increases for indirect energy use, i.e. through increased prices for consumption goods, food and services, are comparatively small.
- Under several simplifying model assumptions, sustaining current price levels ('baseline scenario') throughout 2022 would imply a total burden of EUR 583 bn for households in the European Union, or EUR 3,200 per household.

Household impacts are heterogeneous across income groups

- Across all European households, energy price increases affect low- and middle-income households more than high-income households relative to their total expenditures (regressive impact): in our 'baseline scenario', the poorest 10% face average cost increases of 20% (of total household expenditures), while the richest 10% face average costs of 13%.
- Poor households (i.e. among the poorest 40% of European households) with high energy costs are particularly affected: 11 million inhabitants (2.6% of all households) would require at least 50% of their current expenditures to compensate for increasing energy prices; 48 million inhabitants (11.5% of all households) would need a quarter of current expenditures.

Compensation schemes can mitigate cost burden for households

- Targeted transfers can effectively cushion adverse distributional effects. Frequently discussed consumption tax cuts (such as VAT or energy taxes) or price caps are less targeted to households in need, hence unnecessarily expensive, and do not provide incentives to reduce energy consumption. Moreover, low energy tax rates and minimum VAT levels across the EU limit the impact of consumption tax cuts.

[1] The 'baseline scenario' assumes price increases of 340% for natural gas, 83 % for crude oil and 150 % for coal compared to the long-term average, which correspond to current price levels (May 2022). An embargo scenario assumes price increases of 700% for natural gas, 133% for crude oil and 250% for coal.

[2] We exclude Austria, Malta and Slovenia as underlying data are not available in sufficient quality.

- A targeted transfer to vulnerable households with low incomes and exceptionally high additional expenditures could help to reduce those households' cost burden substantially. Such a compensation scheme would entail total costs of EUR 93 bn (up to 1.6% of domestic GDP).
- For comparison: A less targeted transfer to all households that use gas, independent of their income levels, would cost three times as much (EUR 275 bn). A transfer that equals the national average costs increase across all fuels would lead to a very high cost burden for selected EU countries: 63% of transfers would fall on the five most affected EU countries (Hungary, Italy, Romania, Germany and Poland), with national cost burdens ranging from 6.0-8.3% of countries' respective GDPs.
- In practice, targeted transfer schemes can be implemented via different policies. Examples comprise income tax cuts, up-scaling of existing social transfer schemes, direct cash transfers or other country-specific design options.

Policy implications

- Very high household burdens in the short-term might warrant targeted compensation schemes to the most vulnerable households with particularly high energy costs.
- The combination between a joint interest of EU countries to support Ukraine and to reduce fossil fuel imports from Russia, but a very unequal burden arising from higher energy prices, suggests implementing a sharing mechanism across EU countries.
- A sharing mechanism could also ensure the support of all EU countries to further reduce, or even halt the import of Russian fuels, and at the same time minimize the strategic threat of a fuel supply stop by Russia.
- Beyond transfers to alleviate short-term impacts on European households, increased efforts to reduce dependency on fossil fuels in the medium-term are necessary, for example by strongly supporting renewable energy deployment and energy efficiency across all sectors.

1 Introduction

As a reaction to Russia's invasion of Ukraine, the European Union (EU) has decided on an import embargo on Russian coal starting from August 2022 (European Commission, 2022a), while an import ban on Russian oil in late 2022 is currently under discussion (CNN, 2022). Both Russia and the EU consider limiting or stopping natural gas deliveries. Russia has already halted deliveries of natural gas for Poland, Bulgaria and Finland.

Fossil fuel prices have increased notably since the onset of Russia's invasion, exacerbating substantial price increases since mid-late 2021. Higher energy prices will affect households across the EU, risking a particularly high cost burden to low-income households. Additional costs entail a high political relevance, as they have led to public protests in the past, for example by the French "yellow vest movement" or the Swedish "Petrol revolt". Nevertheless, higher prices will likely affect European countries differently, depending on their reliance on specific fossil fuels. For example, natural gas constitutes a large share of gross primary energy supply in Italy (40.5%), Netherlands (37.6%) or Hungary (33.5%), while natural gas only plays a minor role in Sweden (2.7%), Finland (6.5%) and Estonia (7.7%) (see Figure A1 in Appendix, based on Eurostat, 2022a). Understanding country-specific distributional impacts of fossil fuel price increases on European households is crucial to understand the politically feasible solution space in the EU with respect to potential fuel embargoes against Russia. Our analysis is also relevant for designing compensation schemes within and between EU countries to offset adverse income effects for vulnerable households.

This study assesses the distributional impacts of fossil fuel price increases in 24 of 27 EU countries.[3] The analysis includes both impacts from direct fuel consumption as well as indirect effects, e.g. through increases in prices of other goods and services, such as food. Our work fills an important gap in understanding heterogeneous effects of energy price increases on EU level, as existing works (e.g. Kalkuhl et al. 2022) have focused on specific countries or neglected indirect price increases. We build on scenarios for price increases of natural gas, oil, and coal to study the additional costs (incidence) for households in different expenditure groups. Our 'baseline scenario' assumes higher prices of 340% for natural gas, 83% for crude oil and 150% of hard coal compared to the long-term average (see Section 2). These rather conservative price increases are in line with current price levels and assumptions made in other recent studies. We contrast the findings with an 'embargo scenario' that assumes substantially higher fuel prices (700% for natural gas, 133% for crude oil and 250% for hard coal) at the upper end of assumptions made in recent studies. A 'stylized scenario' with doubled prices for all fuels helps to disentangle the specific contribution of each fuel to the additional cost burden of households. The model considers different taxing schemes across European countries to obtain country-specific price increases for European citizens and industries.

Our findings show that the burden for households differs strongly both between and within countries. In our 'baseline scenario', the mean household burden in a quarter of the countries is below 10% of expenditures. However, in another six countries, i.e. Hungary, Romania, Italy, Czech Republic, Germany and Slovak Republic the burden is above 20%. In several countries more than 5% of households would need to spend more than 60% of their expenditures to sustain consumption levels. When jointly analyzing all European households, we find that around 25% percent of poorer households in the four lowest deciles (i.e. the poorest 40% of European households) would need to pay at least an additional 25% of their total expenditures. Natural gas overall contributes most to higher expenditures in most affected countries. Yet, there are stark country differences, which depend on the specific fuel mix. From the perspective of households, gas heating constitutes the largest contributor to higher expenditures in countries, which face highest additional costs. In less affected countries, transport fuels or heating oil are important to explain the additional cost burden. In the 'embargo scenario', the burden for households would roughly double.

[3] We exclude Austria, Malta and Slovenia out of insufficient data quality.

Targeted compensation schemes could offset severe income shocks for many European households. We show how the distributional impact changes under different stylized compensation schemes for i) the poorest 40% of households that use natural gas, ii) all households that use natural gas, and iii) all households independent of their fuel use. In addition, we estimate the costs of each compensation scheme relative to the GDP of each country. Granting poor households using gas a transfer equal to the average level of additional gas costs could offset large parts of the household burden, while the fiscal costs would remain below 2% of GDP even in the most affected countries. Designing a compensation scheme that targets all gas users with a transfer that equals the average gas-induced household burden would compensate all households at similar levels as poor households in the previous scheme, but notably increase the fiscal burden to 3-6% of GDP in the most affected countries. For comparison, we also show results when targeting all households with a transfer that equals the average additional expenditures due to price increases across all fuels. This would lead to a highly progressive outcome especially benefitting low-income households. Yet, such a comprehensive scheme would also impose a high fiscal burden to countries, with costs up to 6-8% of GDP. Our stylized transfer schemes serve as a reference, but do not consider that many European countries have already introduced various policies to balance higher energy prices and to protect vulnerable households (Bruegel, 2022).

2 Scenarios and Methods

This section briefly recaps recent fuel price developments, describes price assumptions made in our scenarios and previous studies, and finally outlines our overall analysis approach.

Wholesale prices for natural gas, oil, and hard coal have already increased substantially in late 2021 and even further since Russia's invasion of Ukraine. Gas prices (TTF) have increased after a long period of prices ranging between 20-30 EUR/MWh from mid-2021 to 80-120 EUR/MWh in late 2021 (Trading Economics, 2022a). Despite a short peak above 200 EUR/MWh right after the beginning of Russia's invasion of Ukraine, the price has mostly been around 100 EUR/MWh since mid-March. Oil prices (Brent) have mostly fluctuated between 50-70 USD/bbl since 2015, with peaks between 30-90 USD/bbl (Trading Economics, 2022b). Prices plummeted with the economic shock induced by the COVID-19 pandemic to 20 USD/bbl, and have since then gradually recovered up to around 80 USD/bbl in late 2021. Oil prices further increased since the Ukraine war to around 110 USD/bbl, with a range between 100-120 USD/bbl (Trading Economics, 2022c). Prices for hard coal increased in 2021 to roughly 150 USD/t of coal, with peaks between 100-250 USD/t, after prices were stable between 50-100 USD/t from 2012-2019. Since the Ukraine war, coal prices have ranged between 250-400 USD/t.

To analyze how price increases affect household expenditures, we create different scenarios of increased fuel prices relative to historical prices. The 'baseline scenario' assumes mean price levels in 2022 for natural gas, oil, and coal at the lower bound of recent post-war levels. This rather conservative scenario aims at reflecting a political environment that will have stabilized around the status quo (as of May 2022). Specifically, it assumes a wholesale natural gas price (TTF) of 110 EUR/MWh, a crude oil price (Brent) of 110 USD/bbl, and an international hard coal price of 250 USD/ton of coal. The corresponding price increases amount to 340% for natural gas, 83% for oil, and 150% for hard coal (see Table 1). Our 'embargo scenario' assumes higher prices for all three fuels, with prices ranging at the upper end of estimates made in other studies (see below), amounting to 700 % for natural gas, 133% for oil and 250 % for coal. It serves to illustrate a worst-case scenario (from a perspective of energy prices of consumers). However, we highlight that prices in case of a complete embargo are inherently uncertain. Finally, we create a 'stylized scenario' with an identical increase of 100% for each fuel, which illustrates the individual contribution of each respective fuel to the household burden and allows to disentangle direct and indirect cost effects.

The price increases for natural gas and oil in our scenarios are in line with estimates made in previous analyses (see Technical Appendix). The reviewed studies have been published after Russia's invasion in Ukraine and are based on different models and assumptions for energy prices and other economic

parameters. The scenarios range from a normalization in the near future, to full embargos of fossil fuels from Russia, thus leading to a wide range of expected oil and gas prices. Most 'baseline' or 'positive' scenarios assume average natural gas prices in 2022 of 100-150 EUR/MWh and oil prices of at least 80 USD/bbl, mostly more than 100 USD/bbl. More 'negative' or 'embargo' scenarios assume gas prices of 150-200 EUR/MWh, and oil prices around 110-140 USD/bbl, or even higher. The prices for both energy sources usually project a drop in 2023, although the magnitude of the price drops differs between the respective scenarios. Our 'baseline scenario' is thus of similar magnitude as related analyses. The coal price of 250 USD/ton matches the World Bank Commodities Price Forecast for Australian coal in 2022 (World Bank, 2022). Figure 1 illustrates the relation between historical gas prices (a), the price assumptions in our scenarios (b), and prices from our recent analyses (c).

	Historical price (2017-2021)	Baseline scenario price	Baseline scenario increase	Embargo scenario price	Embargo scenario increase	Stylized scenario increase
Natural gas (EUR/MWh)	25	110	340%	200	700%	100%
Oil (USD/bbl)	60	110	83%	140	133%	100%
Hard coal (USD/t of coal)	100	250	150%	350	250%	100%

Table 1: Scenarios of energy price increases. The table shows for natural gas, oil, and hard coal the historical price (column 1), the prices for the 'baseline scenario' and the 'embargo scenario' (2,4), and the increase of prices in all three scenarios (including the 'stylized scenario') relative to the historical price (3,5,6).

Drawing on changes in wholesale fuel prices, we calculate additional costs to households. We account for country-specific fuel prices and (energy) tax schemes by multiplying the market price component of each fuel in each country, i.e. the price before taxes, with a markup factor that corresponds to the price increase of the wholesale price in the respective scenario. Afterwards, we add country specific energy taxes and the value-added-tax (VAT). We thereby assume a complete pass-through of wholesale price increases to retail prices, corrected by country-specific unit and ad-valorem taxes. For natural gas, we distinguish between household prices and non-household prices, while oil price changes apply differently to retail prices for gasoline, diesel, heating oil, and LPG (regardless of the consumer group). Our reference consumer prices for natural gas, gasoline, diesel, heating oil, and LPG build the average between 2017 until late 2021 using Eurostat data (2022b, 2022c). For coal we use the simplifying assumption that the wholesale price increase directly increases input prices for non-household consumers. We thereby neglect potential price differences for coal that is used directly by households, and that prices for lignite are determined by domestic long-term contracts that are independent from hard coal prices. We thus overestimate the impact of coal. The Technical Appendix provides further details about modeling retail price changes.

We combine price changes for fossil fuels with household expenditure data and multi-regional input-output data to assess the additional costs for households. Additional (overnight) costs consist of price increases for energy fuels and services that households consume directly (direct effects - e.g. natural gas for heating, diesel for transportation), and price increases for food, goods and services (indirect effects). We use a multi-regional input-output model to calculate direct and indirect expenditures on gas, oil and coal, which are embedded in the consumption of each item. This also accounts for imports of fossil fuels. Next, we use household- and item-level expenditure shares to calculate the embedded expenditures on natural gas, oil and coal in each household's consumption. We match household expenditure shares with calculated fossil fuel expenditure intensities (differentiated by item, country and direct/indirect

consumption), to assess the additional costs of households for fossil fuel price increases as stated in our scenarios.

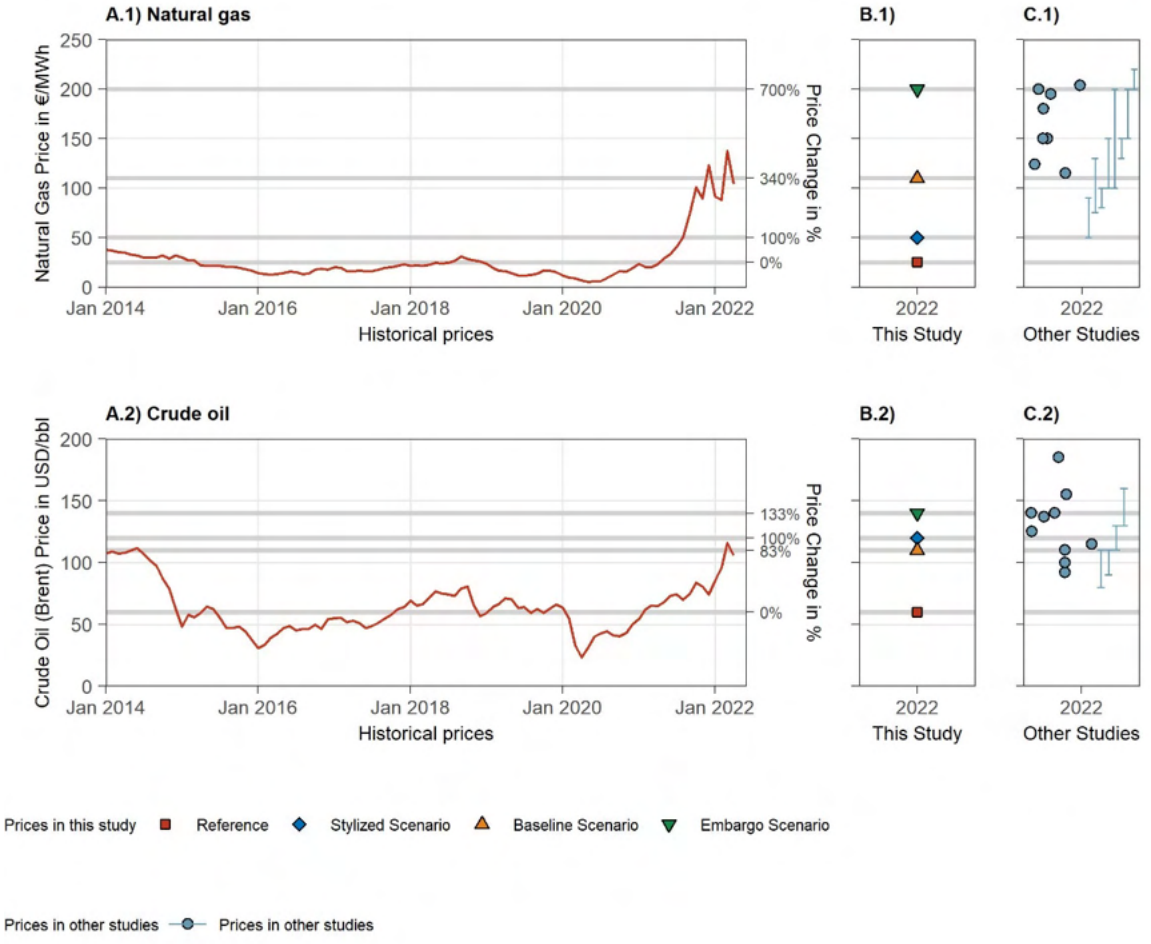

Figure 1: Comparison of natural gas and oil prices. We compare natural gas (1, upper part) and crude oil (2, lower part) with respect to historical prices (A.1 and A.2), price scenarios used in this study (B.1 and B.2), and price estimates or assumptions from other studies (C.1 and C.2). Price estimates or assumptions from other studies include both point values and intervals (see Table TA1 for further details). We obtain historical monthly gas data from the World Bank (2022b).

Our main variable of interest is the additional cost burden (incidence) for households. It expresses the sum (in Euro), which every household would require to maintain its consumption levels, if fossil fuel prices changed as indicated in the scenarios. To facilitate the comparison across households with different expenditure levels, we show the additional cost burden in percent [%] of total household expenditures. For example, a burden of 10% would imply that a household would require an additional 10% of its current consumption to maintain the previous level. Our calculations thus express 'overnight effects' of energy price increases as we neglect behavioral changes, and therefore expresses an upper estimate of additional costs. The next Section 3 compares this additional cost burden within and across income groups and countries. In a second step, we simulate different compensation schemes, which aim at offsetting the additional costs of higher energy prices. We describe these schemes in Section 4. Infobox 1 supports the interpretation of the used boxplot graphics.

Infobox 1: Interpretation of boxplot figures

Subsidies and taxes in the event of supply bottlenecks

We provide a brief introduction on how to read boxplot figures to facilitate their interpretation in this study. Boxplots display the distribution of outcomes (within different groups). The box (representing the 25th to 75th percentile range) and the whiskers (representing the 5th to 95th percentile range) help to understand the distribution of additional costs within groups (see Figure 2). Outcomes in groups with larger boxes or whiskers are more heterogeneous than in groups with smaller boxes or whiskers. We additionally show the average additional costs of fuel price increases from all fuels (white circle), and gas, oil or coal, respectively (using quadrats and triangles). We complement the average incidence with reporting the median which is less sensitive to outliers. From the perspective of the median, 50 percent of households have higher additional costs, and 50 percent lower additional costs. Comparing average or median between different (expenditure) groups is a simple and helpful way to understand their overall difference.

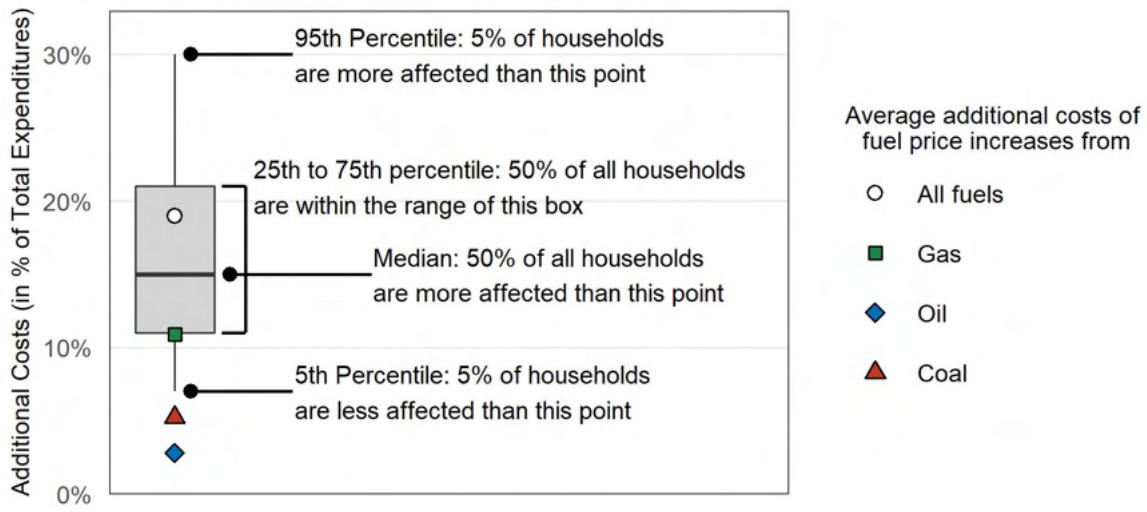

Figure 2: Interpretation of boxplot figures.

Our analyses rely on several simplifying assumptions. Most importantly, we assume an inelastic demand of households, i.e. that households consume the same quantities of goods regardless of higher prices. This strong assumption ignores that households usually respond to price changes although the demand elasticity depends on specific goods and the respective price change. Our 'overnight' distributional effects thus constitute an upper bound for the financial burden of households. Demand changes would reduce financial burdens of households, but reduce welfare from consumption. Other important caveats or simplifying assumptions incur from i) our methodology to translate changes in wholesale markets to consumer prices, ii) abstracting from geographical differences between EU countries in the supply dependence from Russia, iii) neglecting impacts of already implemented compensation schemes of countries and transaction costs (including implementation costs of compensatory policies), and iv) several data limitations that arise from our used household- and input-output data (see extended discussion in the Technical Appendix). We would also like to emphasize that our study exclusively focuses on energy price increases. It thus neglects other price increases, for example related to food supply shocks, or further macro-economic impacts, also of our modeled compensation schemes. Modeling macro-economic impacts has been subject to several other studies.[4]

[4] See list of reviewed studies provided in the Technical Appendix and Krebs (2022).

3 Distributional Implications of Energy Price Increases

Figure 3 indicates the additional costs for households in 24 European countries in our 'baseline scenario' (in percent of their current expenditures). The cost burden strongly differs between countries, ranging between median (average) effects of 25% (31%) in Hungary, to less than 6% (9%) in France. Within countries, differences are also huge: for example, more than 5% of Czech, Hungarian, Italian, Romanian and Slovakian households would require more than 60% of their current total expenditures to afford the same amount of goods and services as before, while 5% would require less than 9% of total expenditures in those countries. In Hungary, 25% of the population would require more than 44% of their current total expenditures. By contrast, the vast majority (95% or more) of households in Bulgaria, Denmark, Estonia, Finland and Sweden would face additional costs of 20% at most. Figure A2 in the Appendix shows an analogous figure for the 'embargo scenario'. The median burden doubles for many countries, or at least increases by factor 1.5. In Hungary, Italy, Romania, Czech Republic, Croatia, and the Slovak Republic, for more than 5% of households, additional costs would increase in the magnitude of their total current expenditures.

Of all three fuels, natural gas contributes most to average expenditure increases in the most affected countries. This results from particularly high price increases for natural gas compared to other fuels in the 'baseline scenario', and comparably gas-intensive economies in these countries. Yet, the average effect of natural gas price increases differs across European countries, being higher than 15% in Hungary, Czech Republic, Italy, Romania, Germany, and Slovak Republic, but only about 3-5% in Sweden, Bulgaria or France. Price increases from oil and coal would, on average, burden European households with not more than 5 % of their current expenditures. Average price effects from oil are highest in Greece, Cyprus and Portugal, while price effects from coal are highest in Poland, Bulgaria and Greece.

Figure 4 highlights the distributional burden of energy price increases across all European households (clustered by expenditure deciles). Overall, the price increase would be regressive, that is, poorer households would face higher additional costs relative to their expenditures. The regressive distribution stems from an unequally distributed burden from natural gas price increases, while higher oil or coal prices are spread more evenly across deciles. Moreover, the burden on households within expenditure deciles is particularly unequally distributed (see whiskers in figure), especially for households in low expenditure groups.

Our analysis shows a large number of potential 'hardship cases', defined as poor households with particularly high energy costs. For example, 2.6% of all European households (11.1 million inhabitants of analyzed countries) would be confronted with cost increases of at least 50% of their total expenditures, while finding themselves among the poorer 40% of all households. 24.5% of households from the lower four expenditure quintiles (or 11.5% of all European households and 48.7 million inhabitants) would face a burden of at least 25% of their total expenditures.

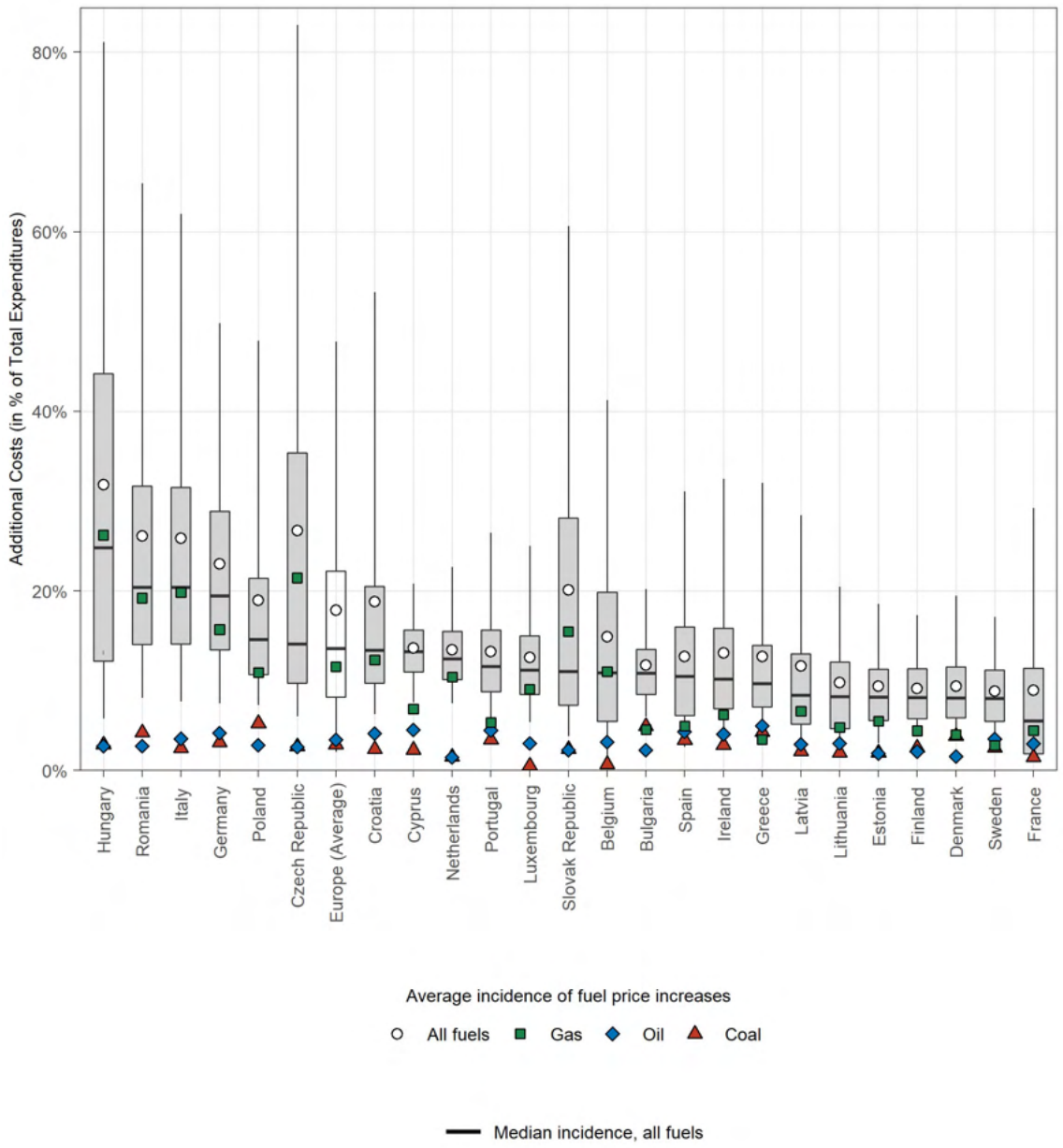

Figure 3: Distributional effects within European countries. The figure shows the additional costs of European households in the 'baseline scenario' in percent of their household expenditures by country. Boxes indicate the 25th to 75th interpercentile range, whiskers indicate the 5th to 95th percentile. The shapes indicate the average expected additional costs following the respective scenario price increases for natural gas (340%), coal (150%) and crude oil (83%). The cost effects include direct and indirect effects. Countries are ordered according to median aggregate additional costs. "Europe (Average)" (white box) indicates weighted distribution across all European households.

Figure A3 in the Appendix shows analogous results for the 'embargo scenario'. We again observe that the additional costs required to maintain consumption would approximately double in magnitude, such that 25% of all household in most deciles would pay more than 40% of their total expenditures, while more than 5% of households in the first four deciles would (almost) need additional expenditures equalling their total current budget to cover additional costs.

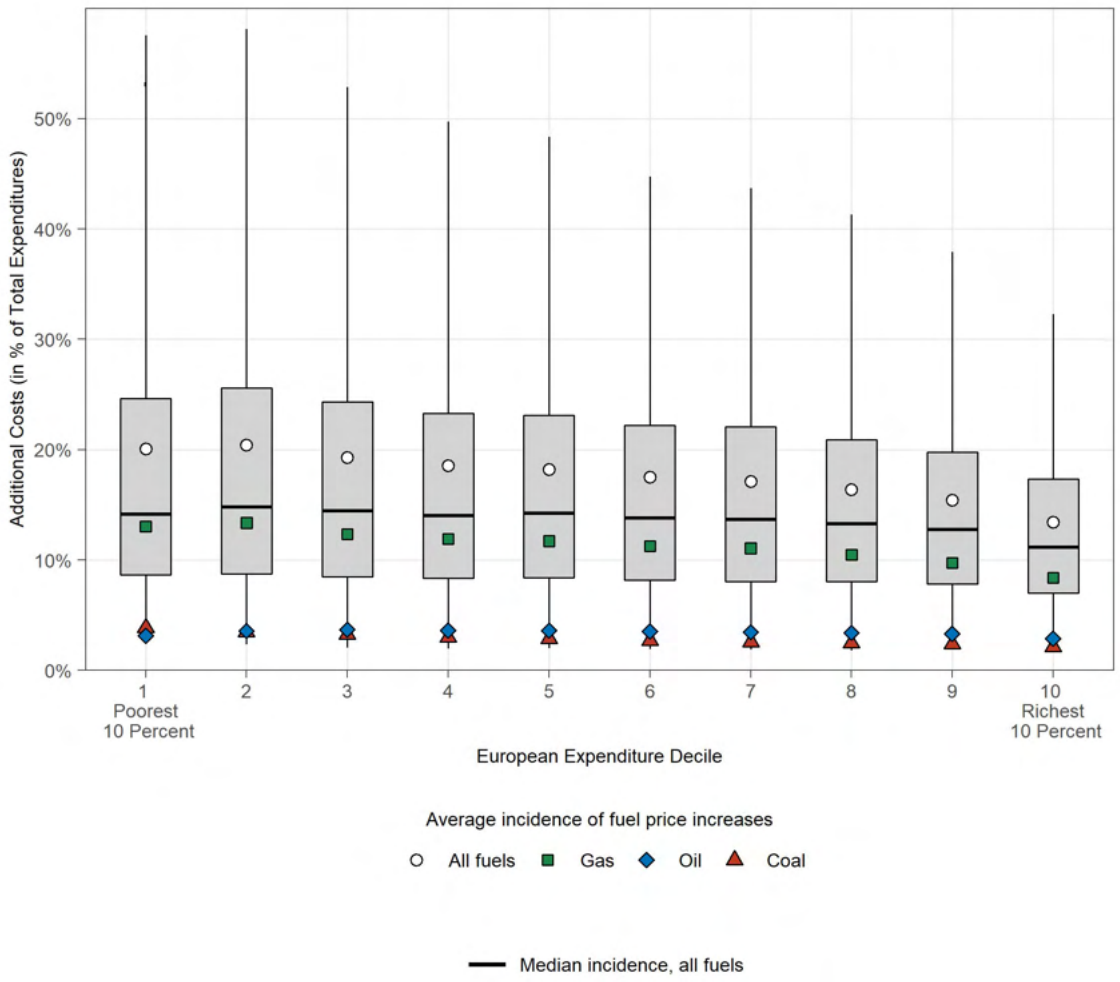

Figure 4: Distributional effects across all European households - 'baseline scenario'. The figure shows the additional costs of all European households in the 'baseline scenario' in percent of their household expenditures by expenditure decile. Boxes indicate the 25th to 75th interpercentile range, whiskers indicate the 5th to 95th percentile. The shapes indicate the average expected additional costs following the respective scenario price increases for natural gas (340%), coal (150%) and crude oil (83%). The cost effects include direct and indirect effects. We assign households to expenditure deciles based on total per capita household expenditures (PPP-adjusted).

Figure 5 shows results of our 'stylized scenario' to illustrate how price changes of each fossil fuel individually contributes to additional household expenditures. A doubling of coal, oil and natural gas prices, respectively, would impact EU households differently: the incidence of gas prices is unequal between countries, with high average effects on households in the Czech Republic, Germany, Hungary, Italy, the Netherlands, Romania and Slovakia, with most of these countries also revealing large within-country differences. Oil price increases would affect households in all EU countries more homogeneously, with highest average effects to be expected in Portugal. Nevertheless, additional costs are spread unequally within countries. Average expenditure shares needed to cover gas price doublings in countries with highest additional costs are of similar magnitude (between 5-10%) as those needed for doubled oil prices. Coal price increases would affect European households least and consistently below 5%, except for more severely affected households in Poland.

Overall, we find that countries are consistently vulnerable to higher oil prices, that the impact of higher gas prices is more concentrated on those countries, in which natural gas is prominent in the heating sector, and that coal price increases are generally least important, with Poland or Bulgaria being exceptions. Figure A4 in the Appendix provides additional detail by showing the impact of doubled prices by quantile and separated between direct and indirect effects. Figure A5 and A6 show analogous to Figure 3 and 4, i.e. distributional impacts for European countries and across all European households.

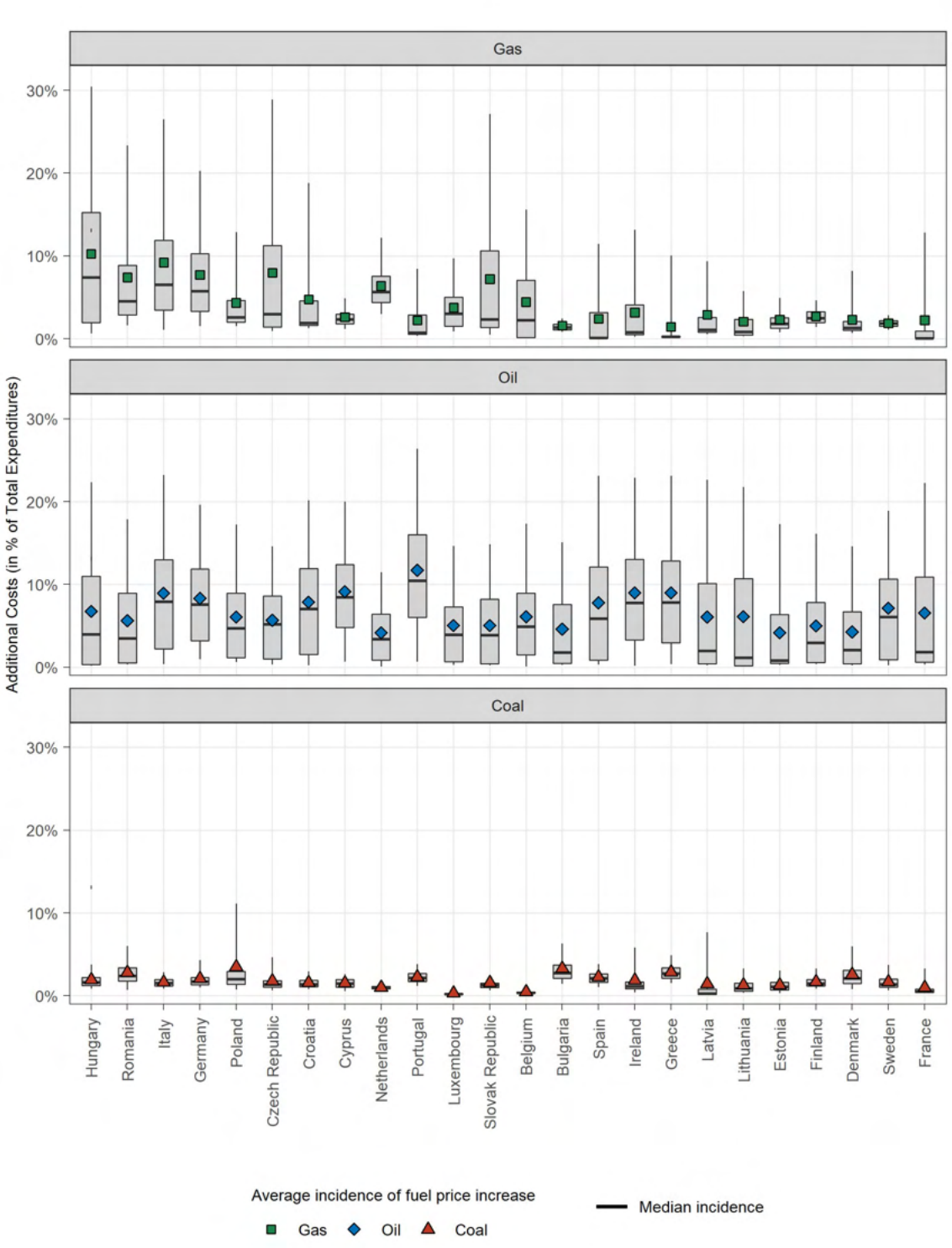

Figure 5: Distributional effects within European countries by fuel - 'stylized scenario'. The figure shows the additional costs of European households in the 'stylized scenario' (doubling of fuel prices) in percent of their household expenditures by country. Boxes indicate the 25th to 75th interpercentile range, whiskers indicate the 5th to 95th percentile. The shapes indicate the average expected additional costs following the scenario price increases for natural gas (100%), coal (100%) and crude oil (100%). The cost effects include direct and indirect effects. Countries are ordered according to median aggregate additional costs.

Figure 6 decomposes the additional cost burden in the 'baseline scenario' by consumption items across countries and for each within-country expenditure quintile. In most countries, gas heating is the main contributor of higher expenditures. This especially applies to countries with a high mean incidence

such as Hungary, where average additional costs from gas heating alone amount to more than 20% of household expenditures across income groups, or in Italy for the poorest quintile. Households, which consume natural gas, especially for heating, face average additional costs that exceed quintile-average additional costs. For example, the average additional costs for gas-using households in the poorest quintile in Hungary amounts to 43% compared to 28% for the quintile-average. Among households at similar income levels, households which use natural gas expect the highest additional costs. Nevertheless, in some countries, such as Sweden or Bulgaria, larger parts of increased household expenditures also stem from transport fuels, heating oil, or electricity prices. This especially applies to countries where the heating sector requires less natural gas than in other countries.

Our method allows us to show how fuel prices indirectly increase prices of other goods, explicitly for food, and aggregated for other goods and services. Indirect effects of fuel price increases on food prices are small in most countries (cost increases of less than 1% of total household expenditures), with Romania, Bulgaria and Croatia being notable exceptions (average additional costs of up to 3% of total household expenditures). We again emphasize that our study does not consider effects on food prices in response to (global) food supply constraints, or any other effects unrelated to energy prices.

Figure 6 additionally shows differences in average cost burdens across within-country expenditure quintiles. On average, price increases would lead to a regressive cost burden in richer countries such as Germany, Italy, Belgium, the Netherlands, France, Denmark or Sweden (i.e. relatively poorer households face higher additional costs than richer households). The opposite applies for several poorer countries, such as Romania or Bulgaria. There, the average cost burden would be progressive (i.e. relatively richer households face higher additional costs than poorer households). In Hungary, Poland and Czech Republic, the highest average burden would fall on households from the second to fourth expenditure quintile. Among others, this reflects country-specific relationships between energy expenditures and total expenditures. The Technical Appendix lists detailed country-level analyses. Inspecting average effects on gas-using households across countries and expenditure quintiles reveals an overall regressive distribution, across both poorer and richer countries. That is, poor gas-using households would be more heavily affected than richer gas-using households, although natural gas is more frequently used among richer households.

Figure 6: Decomposition of costs by country and expenditure quintiles - 'baseline scenario'. The figure shows the average cost increase (in percent of total household expenditures) for each country, expenditure quintile, and consumption category in the 'baseline scenario'. The average cost increase includes direct and indirect effects. The numbers at the top indicate for each expenditure quintile the (rounded) share of households reporting direct expenditures on natural gas. The green squares indicate the average additional costs only for households that use natural gas: Following methodological constraints we are unable to calculate the share of gas users in Germany. See Technical Appendix for further information.

4 Compensation Schemes

Compensation schemes can mitigate impacts following high energy prices, especially for poorer households. Compensating policies can also help to balance social hardships. Indeed, EU member states have already implemented schemes to protect households from increasing fossil fuel prices, while there is an ongoing discussion about a potential EU-wide mechanism (Bruegel, 2022). The implemented schemes comprise transfers to vulnerable households in most countries, a reduction of energy taxes and VAT in the vast majority of countries, while more than a third of countries deploy business support and retail price regulations (Bruegel, 2022).

In this study we calculate three compensation schemes to understand the distributional implications, i.e. additional cost burdens across different expenditure quintiles, and the associated costs per GDP required to finance such schemes (see Table 2 for overview). Calculating the distributional impacts and fiscal costs of the three types of transfer schemes allows us to compare the impacts of the schemes in general, and how they affect different countries relative to each other. We exclusively model transfer schemes, which can be implemented via different policies. Examples comprise income tax cuts, up-scaling of existing social transfer schemes, direct cash transfers or other country-specific design options. Practically implemented policies are usually adjusted to the country-specific context, which may lead to distributional impacts and fiscal costs that, in absolute terms, could substantially depart from our calculations.

Prior to Russia's invasion in Ukraine, legislators already propelled several policies to compensate households for rising energy costs (Bruegel, 2022) with different implications for equity, efficiency, and fiscal burdens. In this study, we exclusively model lump-sum transfers to households with different overall amounts of compensation and groups of targeted households. Transfer schemes can be highly equitable and fiscally manageable if well targeted to households in need, while retaining high energy prices, and thus providing financial incentives to reduce energy. Yet, adequate targeting is necessary to avoid overcompensation of eligible households, or compensating non-eligible households. Inadequate targeting leads to inefficiently high fiscal costs, implying adverse economic impacts due to necessary current or future tax increases. Implementing targeted compensation schemes can be challenging, as determining eligible households 'in need' implies (potentially contested) normative judgements and thus precedes ample political debate, or even resistance. Additional challenges arise from potential data limitations and administrative constraints to available compensation channels.

Compensation scenario	Poor households, only gas	All households, only gas	All households, all fuels
Coverage	The poorest 40% of the population that use gas	All households that use gas	All households
Compensation level	Lump sum transfer that equals the average country-specific expected costs for: natural gas price increase for the poorest 40% of population.	Lump sum transfer that equals the average country-specific expected costs for: natural gas price increase.	Lump sum transfer that equals the average country-specific expected costs for: all fuel price increases.
Fiscal costs	0-1.6% of GDP EUR 93 bn in total	0-5.7% of GDP EUR 275 bn in total	2.1-8.3% of GDP EUR 583 bn in total
Average compensation	EUR 510 per household (EUR 2-1,130)	EUR 1,510 per household (EUR 3-2,970)	EUR 3,200 per household (EUR 590-5,370)

Table 2: Compensation schemes - 'baseline scenario'.

Figure 7 shows the impact of three specific compensation schemes on average budget changes of all households in different expenditure quintiles. The first compensation scheme, 'Poor households, only gas', only targets households from the poorer 40% of population, and only those using gas. The level of compensation equals the average additional costs induced by direct consumption of natural gas and district heat, only. This compensation scheme would lead to strictly progressive outcomes. The average burden for eligible households would decrease, especially in the most affected countries with gas-intensive economies (e.g. Hungary, Italy, or Germany), but not completely offset the average additional cost burden. Households in countries using little or no natural gas (e.g. Sweden, or Finland) would remain largely un- or undercompensated. This transfer scheme could help to cushion unintended and adverse impacts on the poorest households, which might be most vulnerable to impacts of rising energy prices.

The second compensation scheme, 'All households, only gas', compensates all households which use gas, independent of the expenditure quintile. Again, the level of compensation equals the average additional costs induced by direct consumption of natural gas and district heat. In comparison to the scenario 'Poor households, only gas', this scheme would ease the burden of the poorest 40% to a largely similar extent, but at the same level that of households from all other quintiles. As this scheme also does not compensate for price increases from oil and coal, the majority of quintiles across countries would remain undercompensated on average, except for the poorest households in Hungary and Estonia.

The third compensation scheme 'All households, all fuels' compensates all households equally within countries, where the level of compensation equals the average total costs induced by price increases of all fuels in our 'baseline scenario'. This scheme would, in most countries, turn regressive into progressive outcomes (e.g. Italy or Germany), and would balance the burden of households equally across quintiles in other countries (e.g. Netherlands, Denmark or France). The compensation scheme would on average overcompensate a large part of the poorer population (e.g. Hungary, Romania and Italy).

Figure A7 (Appendix) replicates Figure 7, but for a sample restricted to households that use natural gas: Without compensation, additional costs are higher for gas users than for average households within each country and quintile. The figure shows that the 'poor households, only gas' scheme, which directly addresses poor gas users, would effectively ease the cost burden for these households. For example, in Hungary average additional costs in the poorest quintile of more than 35% would almost be entirely offset. As before, compensating all gas using households further increases the compensation across households (relative to compensating only poor gas users), while compensating price increases across fuels would be progressive and notably increases transfers.

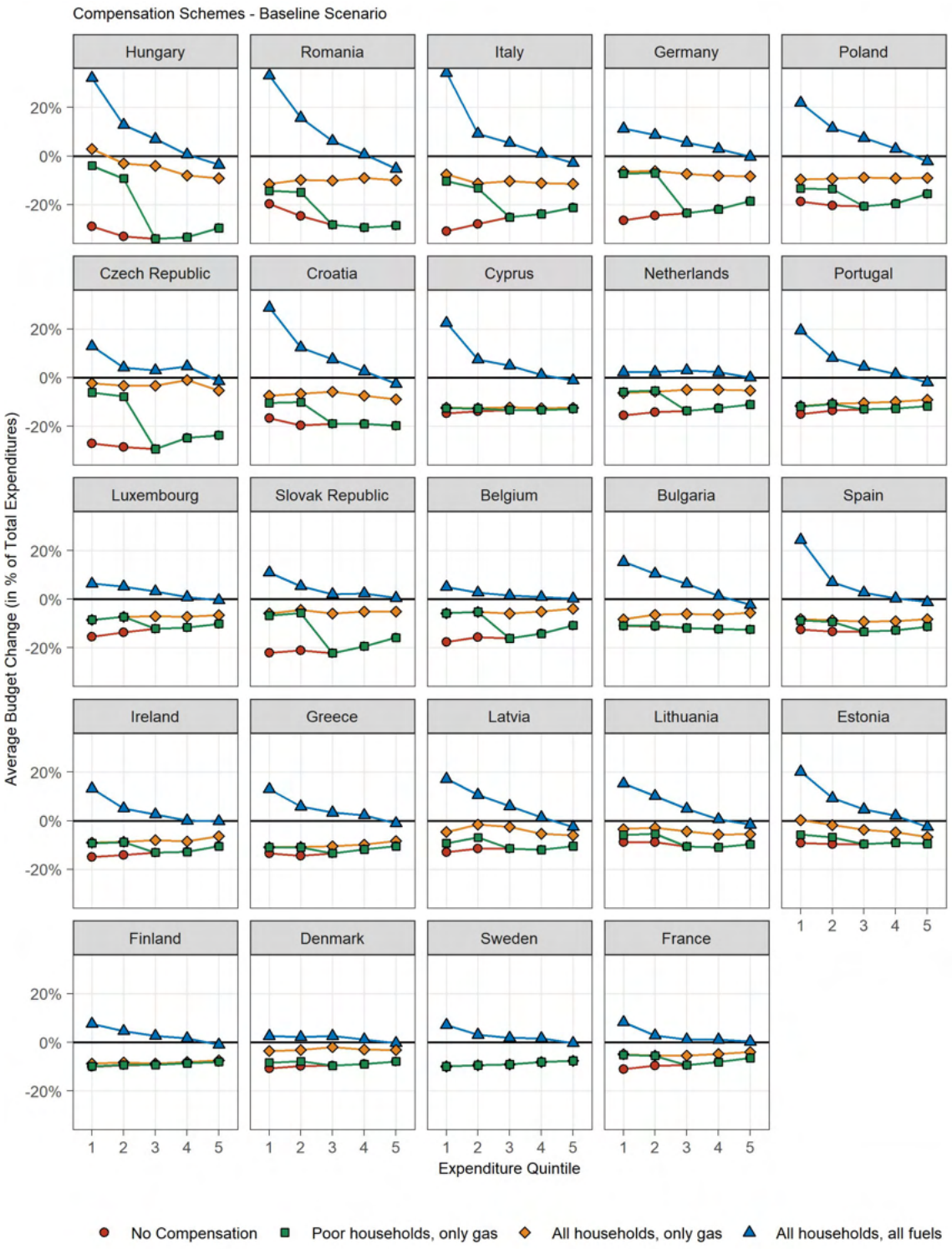

Figure 7: Average effects of different compensation schemes on household budgets. The figure shows the average net expenditure change (in percent of total household expenditures) for each country and expenditure quintile in the 'baseline scenario' for different compensation schemes. The compensation schemes are indicated by the shapes and comprise 'No compensation', 'Poor households, only gas', 'All households, only gas', and 'All households, all fuels'. Negative values indicate uncompensated additional costs, while positive values indicate additional available expenditure budget after compensation. Figure A7 in the Appendix provides a complementary figure, but only for households reporting non-zero expenditures for natural gas. Table A1 in the Appendix additionally shows the share of households with expenditure increases that are higher than 10% and 25% per quintile.

Thus far, we have discussed additional costs by expenditure quintile on average. Nevertheless, average outcomes hide variation within each quintile. This risks overlooking households with exceptionally high costs that may be insufficiently covered by the compensation schemes. We thus calculate the share of households (by quintile) that would require more than 10% (25%) of their total household expenditures, with and without compensation (see Table A1 in the Appendix). Without compensation, more than half of the households in lower expenditure quintiles would require more than 10% of total expenditures to maintain their current consumption levels in Belgium, Czech Republic, Hungary, Italy, Luxembourg, the Netherlands, Poland, Romania and Slovak Republic. At least a quarter of all low income households would face a burden of more than 25% in Czech Republic, Hungary, Italy and Slovak Republic. This share reduces to at most 18% in the 'Poor households, only gas' compensation scheme in all countries. This finding emphasizes the need for compensation schemes that are carefully adapted to country-specific circumstances.

Our model allows us to provide an estimate of aggregate fiscal costs for the illustrated compensation schemes. Figure 8 shows the costs of the three compensation schemes in percent of GDP for each country. In each country, aggregate costs would be highest in the 'All households, all fuels' scenario, with decreasing costs in the 'All households, only gas' and the 'Poor households, only gas' scenario, as the amount of households eligible for transfers decreases. When poor gas users are compensated exclusively, the aggregate fiscal cost for countries most affected would not exceed 2% of GDP (e.g. Czech Republic, Germany, Hungary, Italy, and Slovakia) while the majority of countries would pay less than 1% of GDP. Exclusively compensating gas users induces costs around 2-5% of GDP in most member states, while costs for Hungary increases highest to 5.6% of GDP. Compensating the entire cost increase in the 'All households, all fuels' scenario would impose a very high cost burden to some member states. The highest costs would occur in Italy, Hungary and Germany, with costs between 7.5-8.3% of GDP, followed by 5-7% of GDP for Croatia, Czech Republic, Poland, Romania and Greece.

Other frequently discussed and implemented policies comprise reductions of energy taxes, reductions of VATs, and (retail) price regulations. Those policies are less efficient and may even be less effective than transfer schemes, as lower prices prevent signaling the scarce fuel supply to consumers. Price regulations, as discussed in Germany or implemented in Spain and Portugal (Reuters, 2022a), even entail the risk that demand exceeds supply, implying rationing of energy supplies with potentially substantial costs (Kalkuhl et al. 2022). Tax reductions or retail price regulations further benefit all consumers independent of their cost burden as targeting through differentiated prices is inherently difficult. Block pricing for grid-based energy supplies (electricity, natural gas) could in principle differentiate prices among consumers (e.g. due to their consumption quantities). Nevertheless, even more targeted variations of price-based policies would not provide maximum incentives for reducing energy consumption. Transfers that account for need (i.e. income level) and burden (i.e. level of higher costs), while maintaining prices at market-clearing levels would therefore be the most efficient and socially desirable option, provided that they can institutionally be implemented.

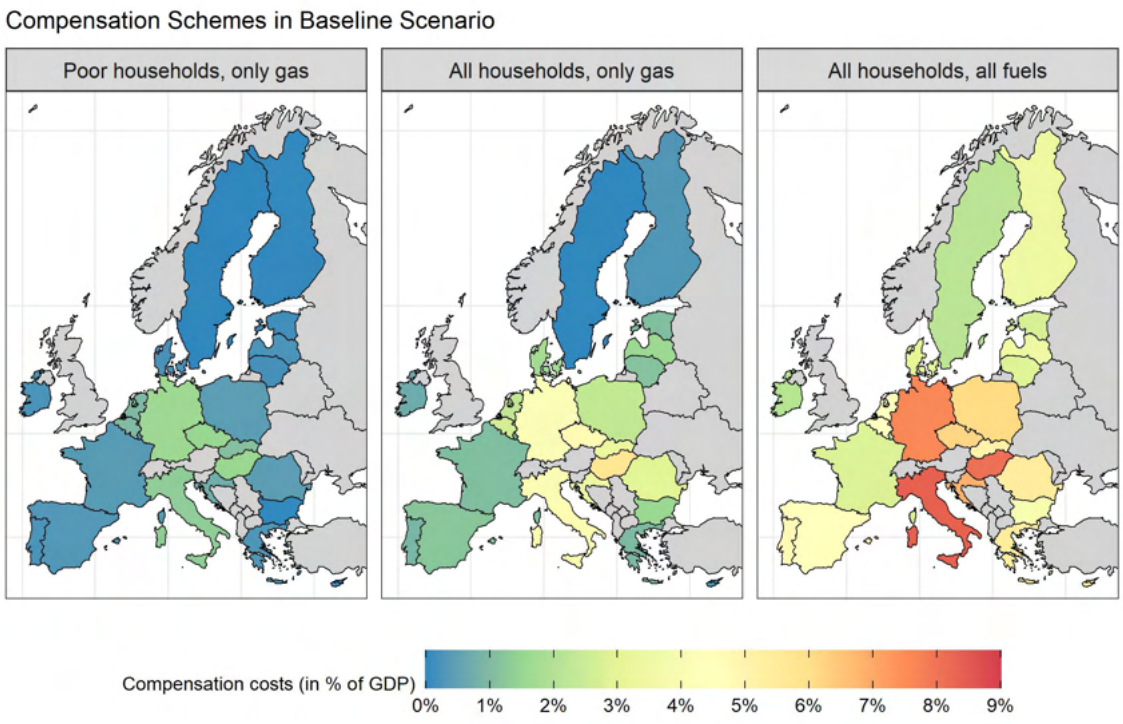

Figure 8: Fiscal compensation costs in percentage of GDP for three compensation scenarios - 'baseline scenario'. The figure shows the financial burden for European countries for the three compensation schemes (see in Table 2) in percent of GDP.

The expected distributional implications of the previously discussed alternative policy instruments might differ. Energy taxes reductions and price regulations reduce direct energy costs for households, and prices for goods with embedded energy. Low-income households usually spend more on energy and food compared to total expenditures than high-income households, at least in richer countries. The effect of lowering taxes on energy and food would thus likely be progressive in most countries, while the magnitude of the compensation would depend on the tax reduction, or the set price, respectively. Yet, in many highly affected countries, such as Hungary, Czech Republic, energy taxes affecting residential gas costs are already low. This leaves limited leeway to use energy tax reductions to compensate households in those countries.

A VAT reduction would decrease the uncompensated burden equally across expenditure quintiles (the red line in Figure 7 would thus shift upwards), at least when (for simplicity) assuming an identical VAT across all goods in the consumption basket.[5] The magnitude of the reduction would, again, depend on the specific VAT reduction. VATs differ across EU countries, and range between 17% (in Luxemburg) and 27% (in Hungary). The minimum standard VAT rate of 15% as regulated in the EU (European Commission, 2022b) limits potential price reductions to a level (between 2-12%) that is substantially below the mean household burden in particularly affected countries (more than 20%). The leverage of this policy to compensate for higher energy prices is thus limited.

5 Conclusions

European households would face a severe costs burden by expected fossil fuel price increases. However, they differ substantially, both between and within countries. In our 'baseline scenario' that

[5] Note that the effect of a VAT reduction would be progressive when considering distributional impacts relative to household incomes instead of expenditures, as (only) richer households save parts of their income.

captures current price levels, highest impacts occur for countries having relatively gas-intensive economies, such as Hungary, Romania, Italy or Germany. Costs would be comparably low in countries with less gas-intensive industry and heating sectors, such as France, Denmark, Sweden or Estonia. Nevertheless, within countries, the heterogeneity of the expected energy bill is substantial. Households that are particularly affected are often i) relatively poor in richer countries, ii) relatively rich in poorer countries, and iii) in general likely to use natural gas for heating. Overall, poorer households are most likely to face the highest additional costs. In our 'embargo scenario', additional costs for households would roughly double compared to the 'baseline scenario'. A further intensification of the conflict between Russia and the EU would therefore increase the pressure of the already high cost burden on households.

Short-term price increases may put particular financial stress on (poor) households that are unable to smooth consumptions via savings due to liquidity constraints. If prices maintain on high levels, inequality in real incomes might further increase. Both effects can be alleviated by compensation schemes that offset the most adverse impacts. We model three stylized compensation schemes that differ on the targeting principle and the level (and reasoning) of the transfer payment. Targeting the poorest households equally at the level of average additional expenditures due to higher gas prices leads to progressive outcomes, implying that low-income households would benefit most. Such a policy would decrease the cost burden for eligible households, especially in most affected countries. A compensation that targets all gas-using households would lead to less progressive outcomes, as it would increase the compensation for medium- and high-expenditure households. Compensating all households equally with a transfer that is equal to the level of average additional expenditures for all fuels leads to the most progressive outcome. Low-income households would profit in particular, and would (on average) be notably overcompensated. None of our compensation schemes considers household-specific energy cost increases, which ultimately decide on the additional household burden, and hence affects the level of compensation required to maintain prior consumption levels. A transfer scheme that considers household-specific energy costs should base the transfer level on past energy consumption before the price increase to ensure a persistent incentive to reduce energy.[6]

Figure 9 summarizes our key findings, combining country-level information on additional expenditures i) at the median, ii) in most affected households and iii) the share of hardship cases (share among the poorest 40% of households with higher additional costs than 25% of total expenditures) (Panel A), and how these would change when introducing the 'poor households, only gas' compensation scheme (Panel B). Introducing the compensation scheme we generally observe that i) the median burden per country decreases (circles move to left), however differently, ii) the burden of the most affected households decreases (circles move downwards), and iii) the share of hardship cases decreases (circles size decreases). Despite illustrating the benefit of our modeled compensation scheme, the figure also demonstrates that it would need an even more precise, and presumably country-specific targeting, to also cover the remaining particularly affected households.

Drawing on our analysis, we see that a compensation scheme, which would target poor gas-users, would entail costs of less than 2% of GDP, even in most affected countries (e.g. in Germany, Hungary and Italy). Targeting all households with a transfer that is oriented at average costs increase of all fuels would require up to 7-8.3% of GDP in most affected countries. Across Europe, costs to cover this compensation scheme for the 'baseline scenario' would account for EUR 583 bn per year - only targeting poor gas users would cost EUR 93 bn. In our 'embargo scenario', targeting poor gas users would cost EUR 188 bn. To illustrate the magnitude: the 'NextGenerationEU' stimulus package to address economic impacts from the COVID-19 pandemic comprises EUR 809 bn of loans and credits over seven years between 2021-2027 (European Commission, 2022c). Nevertheless, our approximate compensation costs only serve for general guidance, while practically implemented schemes need to be more refined, and consider the country-specific institutional context to adequately cover vulnerable households that are particularly affected.

[6] In contrast, adapting the transfer level over time based on the energy consumption after the price increase would reduce the incentive to reduce energy. The incentive structure of the policy instrument would then equal that of a price reduction.

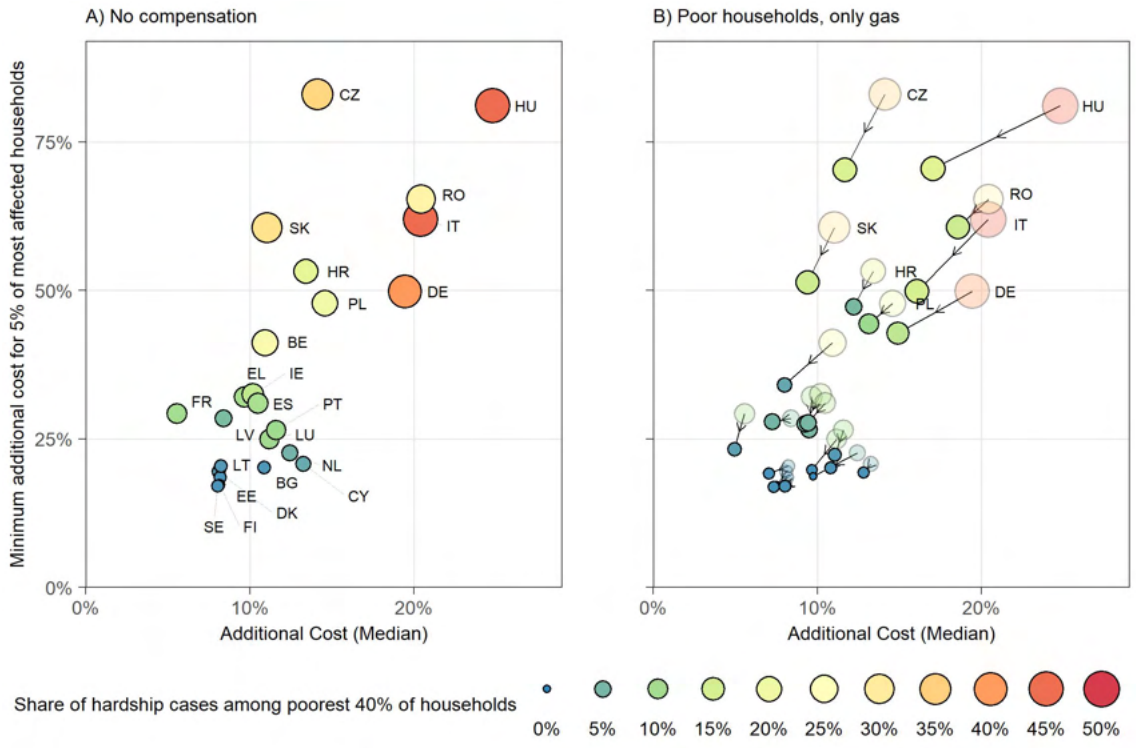

Figure 9: Median additional cost over minimum additional costs for 5% of most affected households. The figure locates each country according to its median burden (x-axis), and the minimum additional costs for the 5% of most affected households (y-axis) in the 'baseline scenario'. Moreover, it shows the share of hardship cases by country, i.e. how many households among the poorest 40% would have to pay more than 25% of their current expenditures, without compensation (A), or for a compensation scheme that targets poor gas users (B).

A European solution to share some of the burden of national compensation schemes across EU members might be politically necessary if all members of the EU were to enact or facing an embargo, as poor and highly affected countries might have difficulties balancing social outcomes of related energy price increases. The burden for European countries differs strongly, with high cost burdens in countries with comparably gas-dependent economies. This raises the question, whether each country should finance its respective compensation schemes by themselves, or whether a European financing scheme involving cross-country transfers could, or should be an option. Indeed, the Hungarian government has recently asked for finance and compensation for the modernization of Hungary's energy infrastructure, which would cost EUR 15-18 bn, in order to be able to agree to an European oil embargo (Reuters, 2022b). It speaks in favor of a solidary European solution that independence from (Russian) fossil fuel imports is of common interest, yet, the costs burden would be distributed unequally. Transfers to European states that obstruct an EU-wide oil (or gas) embargo may therefore facilitate a common geopolitical policy and spur agreements on sanction mechanisms against Russia. In addition to financial transfers, a secure, or at least, solidary fuel supply could be a means to mitigate disproportional (fiscal) impacts arising for individual European states.

Compensating households should be perceived as a short-term solution to the ongoing energy price shock, i.e. with the goal to ease political acceptance for joint policies targeted against Russian energy imports. It should not deter from medium-term efforts to mitigate climate change that can ease the substitution away from fossil fuels. Promoting the installation of heat-pumps in the heating sector, or altering transport infrastructure in support of shared cars, public transport or bicycles could be specific measures that could reduce fossil energy demand (see also IPCC (2022)). **Since facilitating the substitution of fossil fuel use towards cleaner forms of energy supply might not be possible in the short-term, targeted compensation schemes will be a cornerstone of equitable and efficient policy in times of rising energy prices.**

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Appendix

The Appendix includes all additional figures and tables that the text refers to. In addition, we provide an (online) Technical Appendix (https://doi.org/10.5281/zenodo.6574170) that contains i) an overview of previous studies, ii) extensive methodological details including the data used, and iii) a discussion of caveats and limitations. The following figures and tables are described in the respective captions.

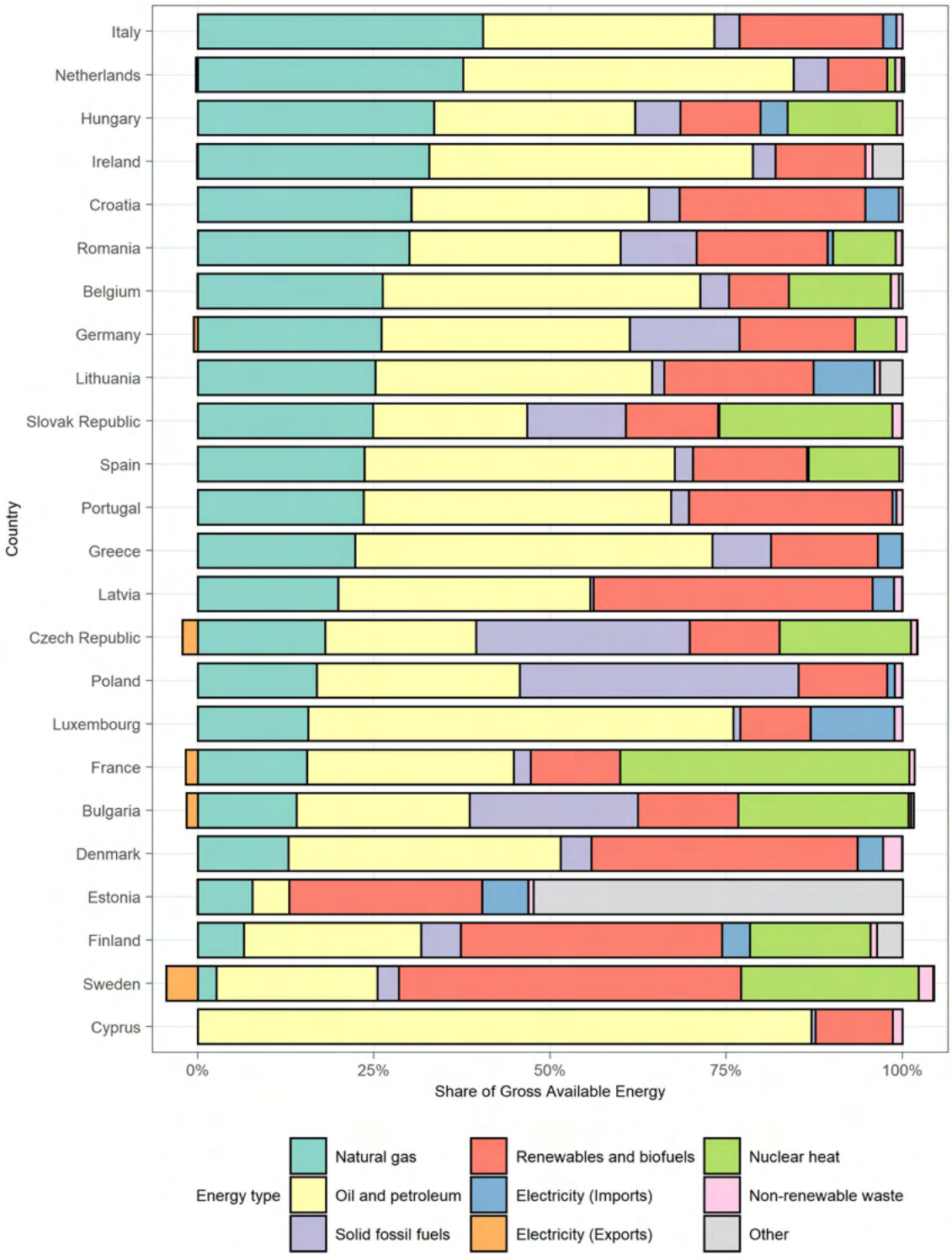

Figure A1: Energy mix by country. The figure shows the energy mix of each European country sorted by descending shares of natural gas.

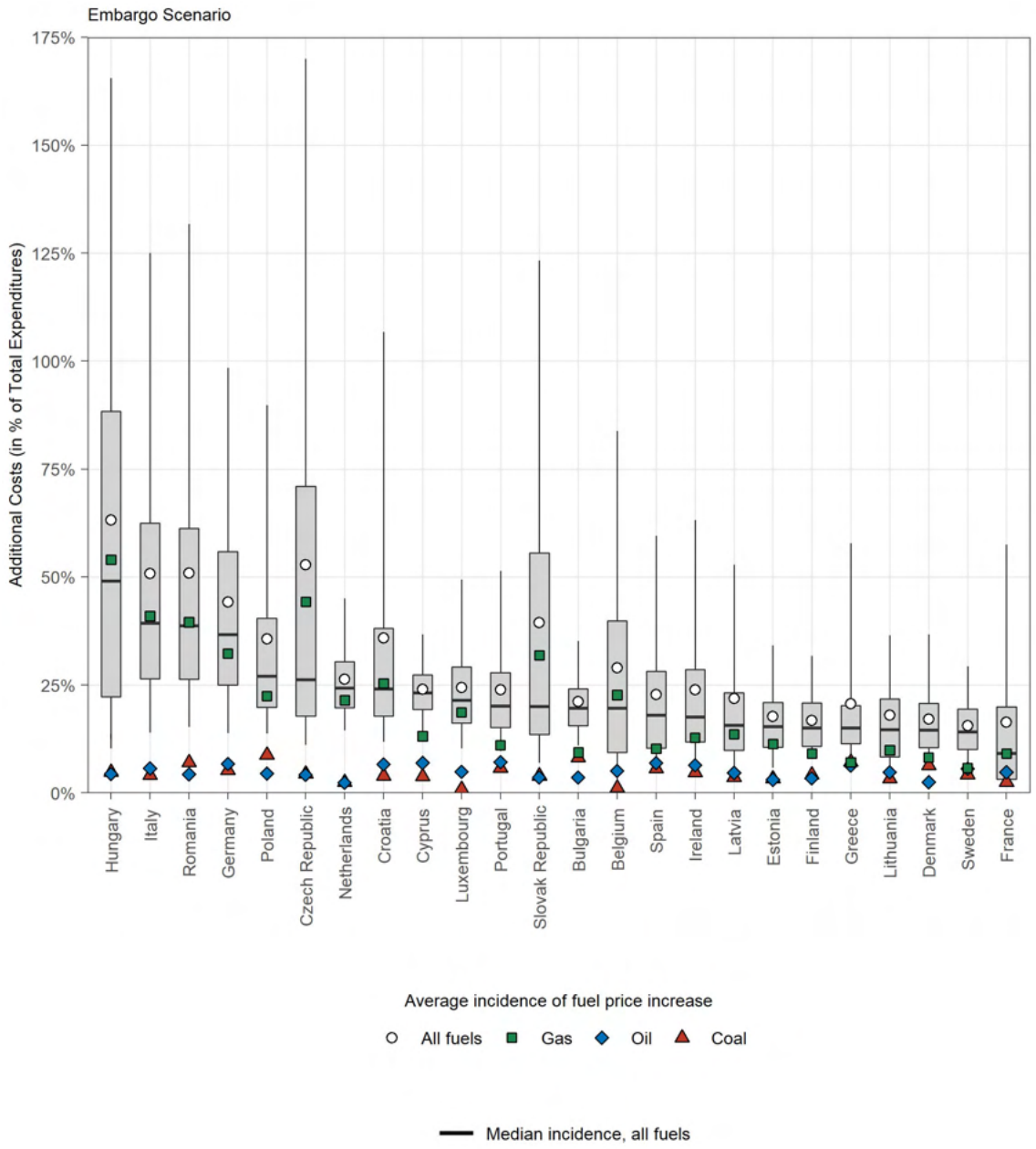

Figure A2: Distributional effects within European countries - 'embargo scenario'. The figure shows the additional costs of European households in the 'embargo scenario' in percent of their household expenditures by country. Boxes indicate the 25th to 75th interpercentile range, whiskers indicate the 5th to 95th percentile. The shapes indicate the average expected additional costs following the respective scenario price increases for natural gas (700%), coal (250%) and crude oil (133%). The effects include direct and indirect effects. The countries are ordered according to median aggregate additional costs.

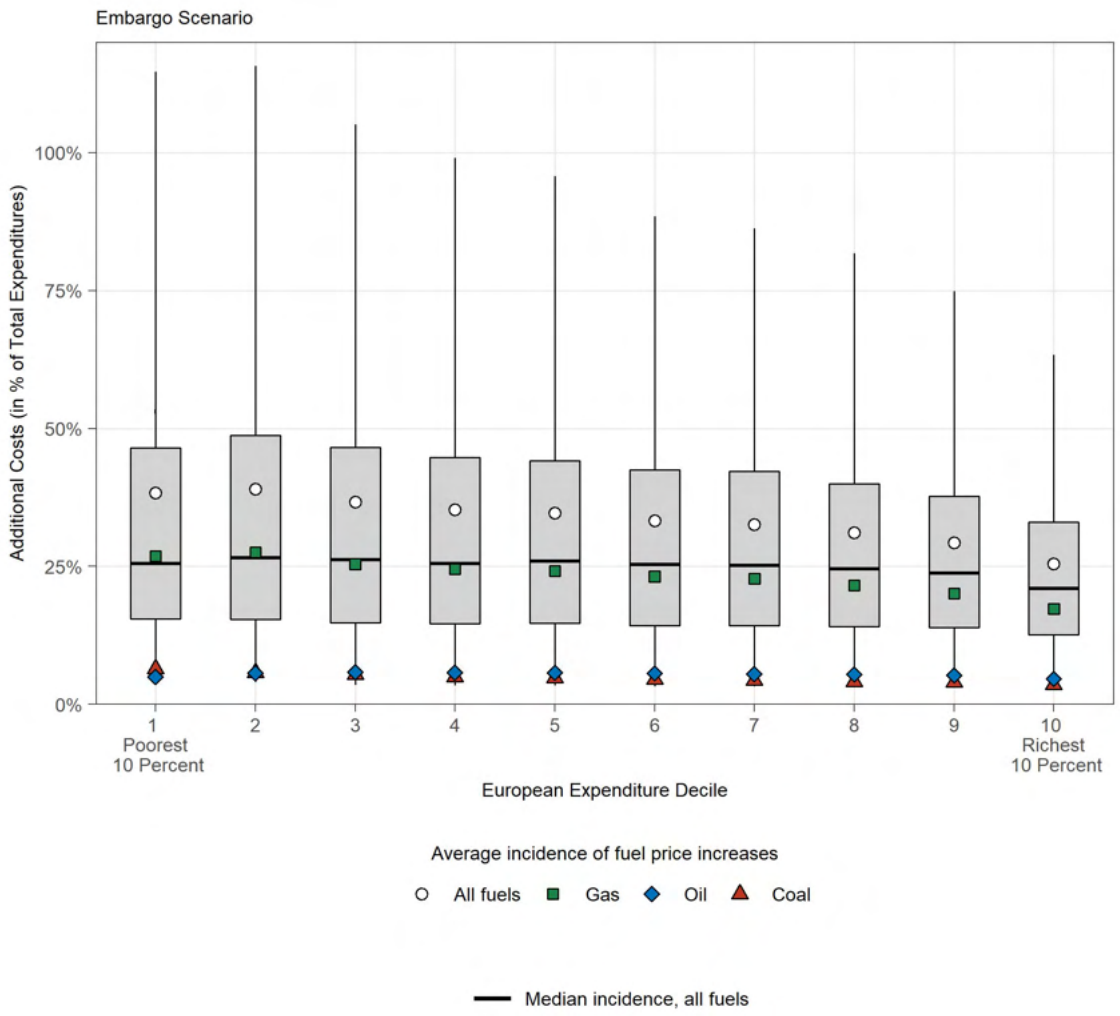

Figure A3: Distributional effects across all European households - 'embargo scenario'. The figure shows the additional costs of all European households in the 'embargo scenario' in percent of their household expenditures by expenditure decile. Boxes indicate the 25th to 75th interpercentile range, whiskers indicate the 5th to 95th percentile. The shapes indicate the average expected additional costs following the respective scenario price increases for natural gas (700%), coal (250%) and crude oil (133%). The effects include direct and indirect effects. We assign households to expenditure deciles based on total per capita household expenditures (PPP-adjusted).

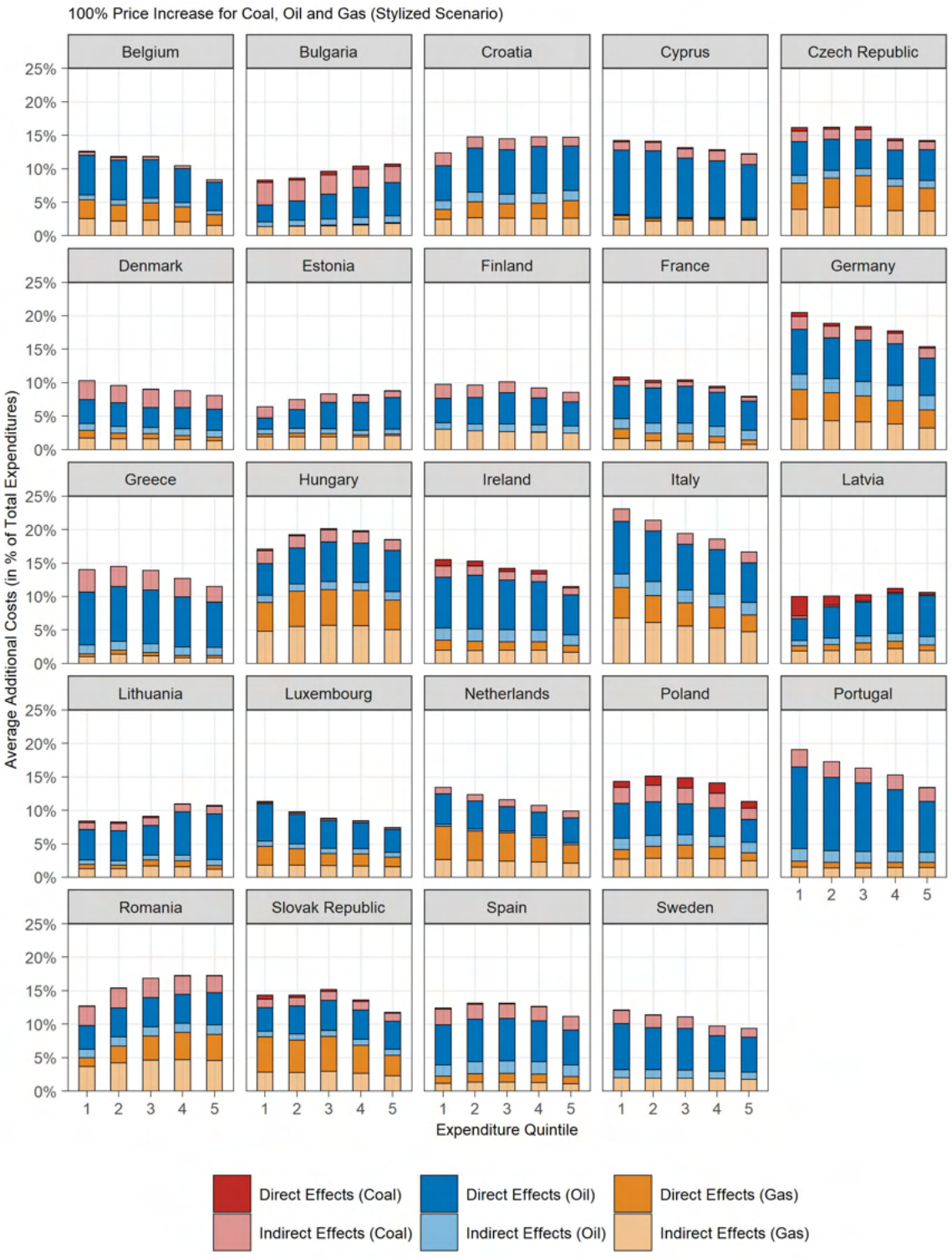

Figure A4: Decomposition of direct and indirect effects for coal, oil and natural gas - 'stylized scenario'. The figure shows the average cost increase (in percent of total household expenditures) for each country, expenditure quintile in the 'stylized scenario', decomposed by direct and indirect effects of natural gas, oil, and coal, respectively.

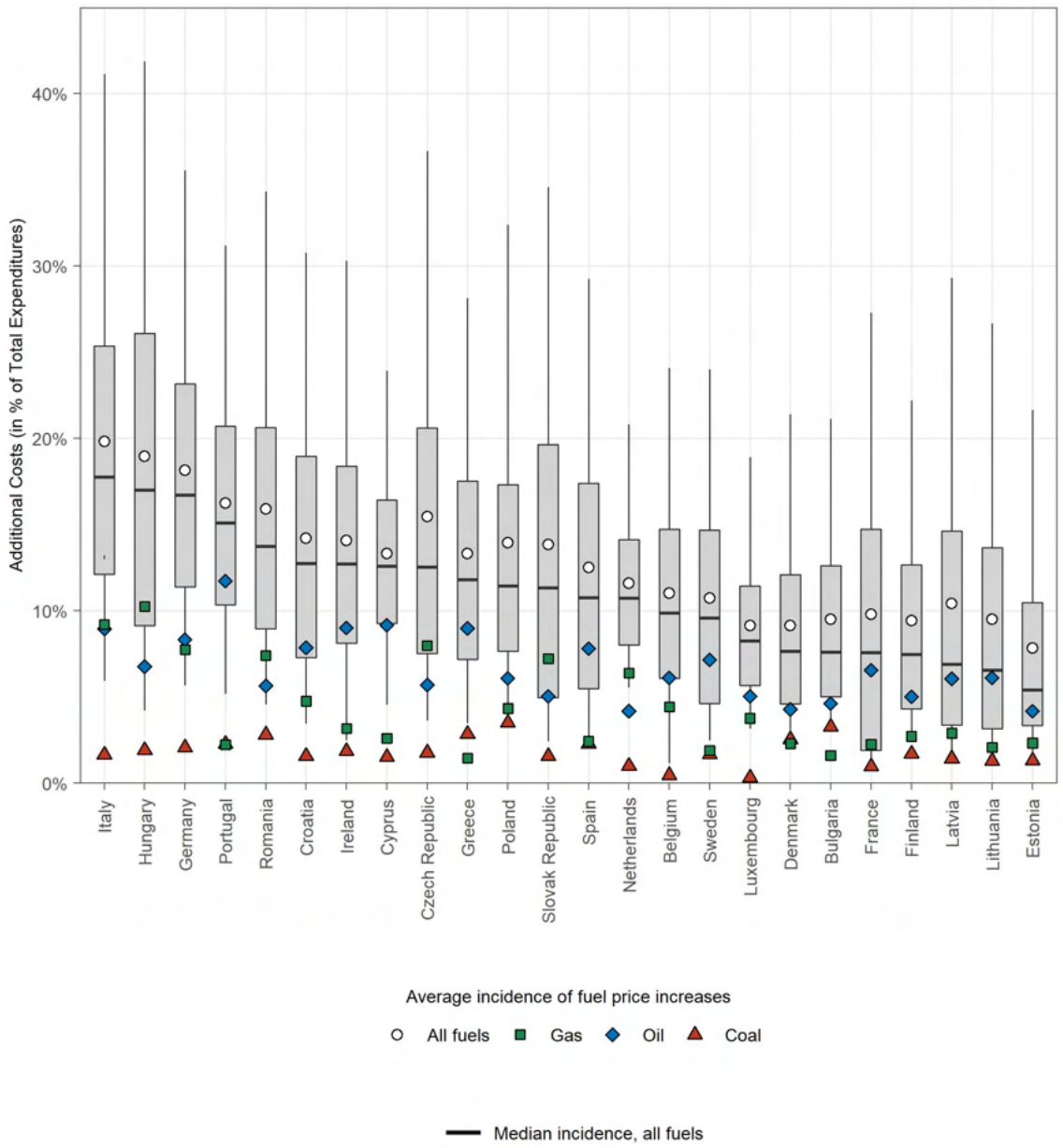

Figure A5: Distributional effects within European countries - 'stylized scenario'. The figure shows the additional costs of European households in the 'stylized scenario' in percent of their household expenditures by country. Boxes indicate the 25th to 75th interpercentile range, whiskers indicate the 5th to 95th percentile. The shapes indicate the average expected additional costs following the respective scenario price increases for natural gas (100%), coal (100%) and crude oil (100%). The effects include direct and indirect effects. The countries are ordered according to median aggregate additional costs.

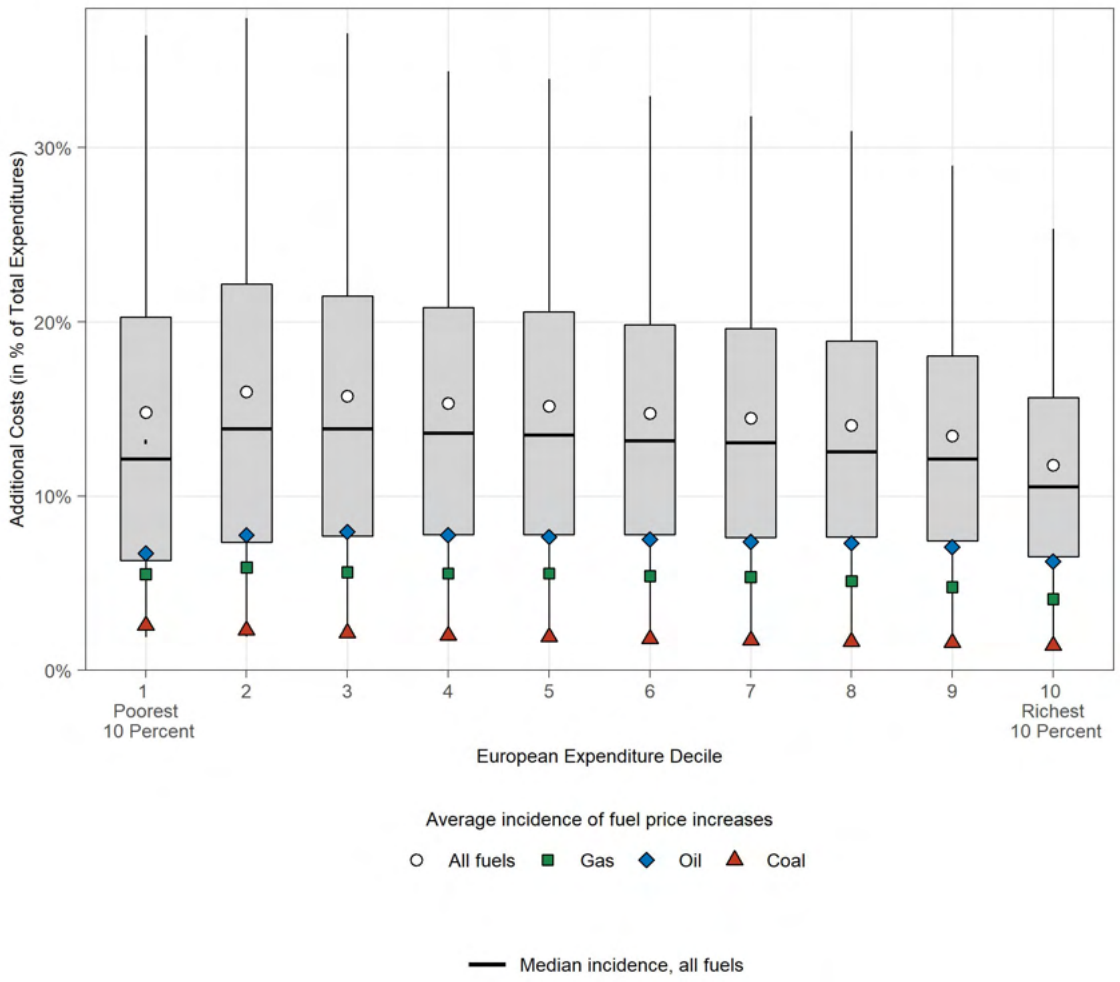

Figure A6: Distributional effects across all European households - 'stylized scenario'. The figure shows the additional costs of all European households in the 'stylized scenario' in percent of their household expenditures by expenditure decile. Boxes indicate the 25th to 75th interpercentile range, whiskers indicate the 5th to 95th percentile. The shapes indicate the average expected additional costs following the respective scenario price increases for natural gas (100%), coal (100%) and crude oil (100%). The effects include direct and indirect effects. We assign households to expenditure deciles based on total per capita household expenditures (PPP-adjusted).

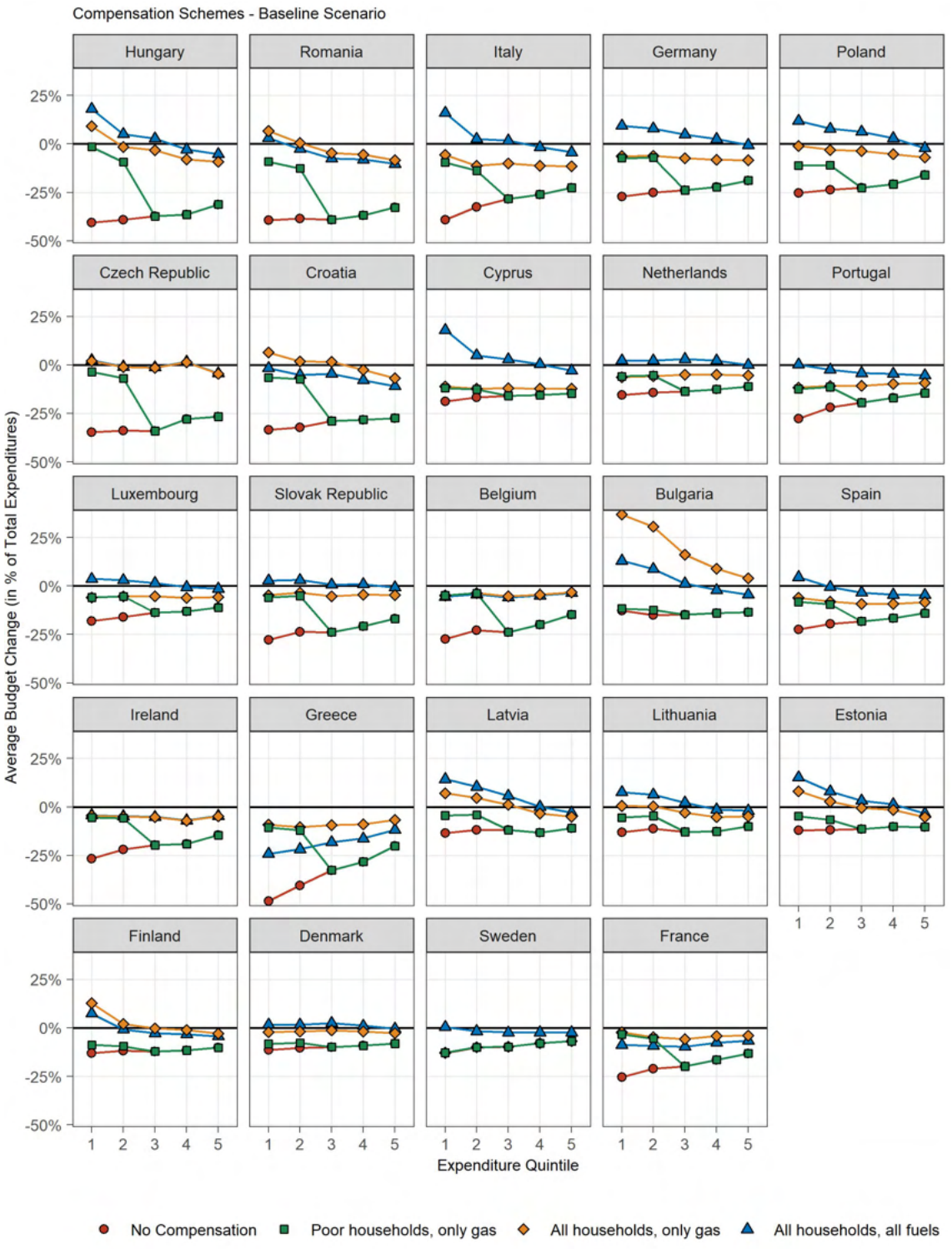

Figure A7: Average effects of different compensation schemes - only households using gas. The figure shows the average net positive expenditure shares (in percent of total household expenditures) for each country and expenditure quintile in the 'baseline scenario' for different compensation schemes. In contrast to Figure 7, only households that use gas are included in the sample. The compensation schemes are indicated by the shapes and comprise 'No compensation', 'All households, all fuels', 'All households, only gas', and 'Poor households, only gas'.

Country	Households affected more than	Compensation Schemes																			
		No Compensation					Poor households, only gas					All households, only gas					All households, all fuels				
		Income quintiles																			
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Belgium	10%	54	51	51	50	41	24	19	51	50	41	24	19	19	20	11	18	16	16	17	10
Belgium	25%	25	19	20	17	7	4	2	20	17	7	4	2	4	3	1	5	3	5	3	1
Bulgaria	10%	27	30	35	44	50	27	29	35	44	50	23	22	22	24	21	1	1	3	5	10
Bulgaria	25%	1	1	2	3	2	1	1	2	3	2	1	1	1	2	1	0	0	1	1	1
Croatia	10%	46	55	59	58	59	34	35	59	58	59	30	31	30	31	32	9	14	16	18	21
Croatia	25%	14	20	21	19	22	3	7	21	19	22	3	7	6	6	9	3	7	6	8	11
Cyprus	10%	57	55	54	53	47	47	48	54	53	47	45	47	47	49	43	1	1	2	2	3
Cyprus	25%	5	2	1	0	0	2	1	1	0	0	1	1	0	0	0	0	0	0	0	0
Czech Republic	10%	65	69	71	69	65	34	36	71	69	65	33	33	31	29	32	24	27	26	25	29
Czech Republic	25%	34	33	33	30	31	14	16	33	30	31	14	16	17	14	14	13	16	17	14	13
Denmark	10%	40	35	32	34	21	25	23	32	34	21	12	10	7	6	6	5	3	3	1	3
Denmark	25%	3	1	1	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
Estonia	10%	27	30	29	26	31	12	16	29	26	31	5	8	11	9	17	1	3	5	3	8
Estonia	25%	1	2	3	1	2	1	2	3	1	2	1	2	2	1	1	0	2	2	1	1
Finland	10%	23	21	19	17	15	22	19	19	17	15	20	16	16	14	11	1	2	1	1	1
Finland	25%	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	10%	28	26	27	23	18	16	15	27	23	18	15	15	14	11	7	12	12	13	10	7
France	25%	11	8	7	5	2	3	2	7	5	2	3	2	2	1	0	4	3	3	2	1
Germany	10%	90	90	90	89	81	40	39	90	89	81	38	37	38	37	34	18	18	19	18	17
Germany	25%	43	38	35	30	20	14	12	35	30	20	13	11	11	10	7	4	4	4	4	3
Greece	10%	28	30	32	28	26	25	25	32	28	26	25	25	26	23	16	5	9	9	8	9
Greece	25%	7	10	9	5	4	3	4	9	5	4	3	4	3	1	0	3	5	4	2	1
Hungary	10%	63	79	85	85	83	27	39	85	85	83	22	31	35	41	42	15	23	28	33	33
Hungary	25%	41	49	56	54	49	14	18	56	54	49	11	14	17	19	18	9	11	12	14	15
Ireland	10%	40	42	42	40	34	24	23	42	40	34	24	23	22	22	14	9	9	10	12	8
Ireland	25%	13	10	9	8	4	4	3	9	8	4	4	3	2	3	1	2	1	1	2	1
Italy	10%	78	83	86	86	87	39	44	86	86	87	34	40	40	43	44	11	18	19	22	23
Italy	25%	48	42	37	33	27	13	16	37	33	27	12	15	12	12	10	4	6	6	6	5
Latvia	10%	35	33	28	26	26	21	16	28	26	26	19	13	14	15	17	2	2	5	9	12
Latvia	25%	5	3	5	7	7	4	3	5	7	7	4	2	4	5	7	2	2	3	5	6
Lithuania	10%	29	30	33	36	33	12	10	33	36	33	9	9	12	13	13	2	3	5	6	7
Lithuania	25%	2	2	3	4	2	1	1	3	4	2	1	1	3	3	2	1	1	2	3	2
Luxembourg	10%	64	58	52	48	40	29	23	52	48	40	29	23	20	19	14	3	2	2	4	1
Luxembourg	25%	11	7	3	3	0	1	0	3	3	0	1	0	1	1	0	0	0	0	0	0
Netherlands	10%	89	84	80	73	57	15	12	80	73	57	17	14	11	11	8	1	1	1	1	1
Netherlands	25%	6	4	3	1	0	1	0	3	1	0	1	0	0	0	0	0	0	0	0	0
Poland	10%	58	67	71	71	61	42	44	71	71	61	32	31	28	26	22	6	10	11	12	12
Poland	25%	17	20	20	16	9	6	8	20	16	9	5	7	8	8	5	2	4	5	6	4
Portugal	10%	46	45	46	50	49	38	35	46	50	49	37	34	33	31	27	4	6	7	8	9
Portugal	25%	11	7	5	4	3	2	2	5	4	3	2	1	1	1	2	1	1	0	1	1
Romania	10%	50	64	72	79	84	40	45	72	79	84	36	37	39	37	38	5	13	21	26	32
Romania	25%	18	31	39	43	44	8	13	39	43	44	6	9	12	12	14	3	6	11	13	14
Slovak Republic	10%	51	55	58	53	50	29	33	58	53	50	29	33	35	31	29	21	25	28	23	22
Slovak Republic	25%	32	31	32	26	18	15	13	32	26	18	15	14	17	13	8	11	9	13	10	6
Spain	10%	36	44	46	46	42	22	27	46	46	42	21	25	27	28	23	5	9	11	13	11
Spain	25%	9	10	9	8	5	4	4	9	8	5	4	4	4	4	2	1	2	2	2	1
Sweden	10%	25	22	19	14	11	25	22	19	14	11	25	22	19	14	11	1	1	1	0	0
Sweden	25%	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Table A1: Share of households with particularly high expenditures. The table shows the share (in %) of households that are affected by more than 10% (25%) by country and quintile, without compensation, and for the three compensation schemes.